SUBSTITUTE SPECIFICATION

US Non-Provisional Patent Application for

ROOFING SYSTEM AND SELF-BRIDGING TAPE FOR MODULAR BUILDING CONSTRUCTION ROOF JOINTS

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Application S/N 10/701,153, filed 11/03/2003

ROOFING SYSTEM AND SELF-BRIDGING TAPE FOR MODULAR BUILDING CONSTRUCTION ROOF JOINTS

[0001] Cross-references to related applications: This application claims priority to U.S. Provisional Patent Application S/N 60/423,069, filed November 1, 2002.

[0002] Reference to sequence listing, table, or computer program listing appendix submitted on a compact disc: N/A.

[0003] Statement regarding federally sponsored research or development: N/A.

Background of the Invention

1. Field of Invention

[0004] The present invention relates generally to modular building construction materials and techniques.

[0005] More particularly, the invention relates to a membrane roofing system for buildings constructed from modular units, and a reinforced laminate tape to bridge and seal the gap at the roof between adjacent modules.

2. Description of Prior Art

[0006] One technique for constructing a building is to fabricate building modules at a manufacturing location, and then assemble the modules together at the building site. Construction of modular buildings in this manner requires bridging and sealing the gap between adjacent or side-by-side modules, particularly at the roof line, after the modules are secured in position. Building modules of this type are commonly

provided with a membrane roofing sheet at the factory. Consequently, after assembly of the modules together in side-by-side relation, the gap between the membrane sheets of adjacent modules must be bridged and sealed to establish a weather proof roof system for the finished building.

[0007] Roofing membranes are conventionally made from one or more of the following, and other generally equivalent elastomeric/polymer compositions such as, but not limited to: EPDM, EPR, TPO, PVC, Neoprene, Butyl, Polyisobutylene, Halogenated Butyl, Halogenated Polyisobutylene, Isobutylene, reclaimed butyl, and natural rubber. Roofing membranes are typically provided with a thickness of between approximately 0.030 inch to 0.060 inch, the thickness depending on circumstances and characteristics desired, as well as on the specific composition and processing of the membrane.

[0008] In the construction of modular buildings, the gap at the roof line between the adjacent modules is typically less than 4 inches. One common technique to establish a joint between adjacent building modules is to install a stiff bridging member over the gap, and then apply an adhesive-backed protective membrane, typically provided in the form of a rolled tape, over the bridging material and overlapping onto the membrane roofing sheets of the adjacent modules. The tape establishes a water-tight seal between the modules, and the bridging material prevents sagging of the tape into the gap between the modules. Another technique available for sealing the roofing gap between adjacent modules is to use an adhesive-backed tape provided with a stiff, fully cured outer membrane that is reinforced with an embedded scrim.

[0009] However, there are drawbacks and disadvantages associated with such prior construction techniques. In the latter case, the reinforced outer membrane produces a non-conforming joint that can exhibit poor sealing characteristics. Consequently, that tape does not readily conform to irregular surfaces, and a high percentage of joints develop leaks, resulting from the imperfect-fitting nature of joints between manufactured modules (e.g., as from manufacturing tolerances), and from inherent uneven edge lifting of adjacent building modules as the modules expand and contract over time. The seal established with the separate bridging material is also a stiff, non-conforming seal that results in the same sealing problems as are experienced with the reinforced outer membrane seal. Use of the separate bridging material also results in substantial additional cost associated with the additional bridging materials and the additional labor and time required for preparation and installation of the bridging materials. As a result of the stiff, non-conforming nature, these prior seal arrangements are also difficult to cut through and disassemble or remove in the event that the modules are to be disassembled, or should inspection or repair of the joint or underlying structure become necessary.

[0010] A completed roofing system in which the gaps between adjacent building modules are flexibly sealed without the above-identified drawbacks and disadvantages would be advantageous by reducing leaks and increasing joint reliability, reducing installation costs, and promoting ease of removal, disassembly, inspection and repair activities.

Brief Summary of the Invention

[0011] The general aim of the present invention is to provide an improved roofing system for modular buildings.

[0012] Another aim of the invention is to provide materials and techniques for bridging and sealing the gaps between roofing membrane sheets of adjacent building modules, without the above-identified drawbacks and disadvantages associated with prior materials and techniques.

[0013] An important objective of the invention is to provide for construction of modular buildings without the need to use a separate bridging member spanning across the gap between adjacent modules.

[0014] Another important objective of the invention is to provide a roof-joint seal that is less expensive than prior seal arrangements utilizing separate bridging and seal materials.

[0015] Another important objective of the invention is to provide a flexible elastomeric seal that bridges imperfect fitting joints commonly associated with adjacent building modules, without sagging into the gap between the modules.

[0016] Another important objective of the invention is to provide an elastomeric seal with an integral, flexible, self-supporting bridging material.

[0017] Another important objective of the invention is to provide a reinforced, flexible elastomeric laminate seal between the membrane roof sheets of adjacent building modules, thereby completing the roof system of the finished building.

[0018] Another important objective of the invention is to provide a flexible elastomeric laminate seal that is also suitable for sealing between walls, concrete and other construction joints.

[0019] These and other objectives and advantages of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

[0020] According to the invention, there is provided a reinforced, flexible, elastomeric, self-bridging laminate tape to bridge and seal the gap between membrane roof sheets of adjacent building modules, and to complete the roof system of the finished building.

[0021] One preferred embodiment tape to bridge and seal the joints between construction modules is provided with a tacky elastomeric adhesive membrane, a porous semi-rigid reinforcing scrim layer embedded in the elastomeric membrane such that the elastomer surrounds and extends through the integral openings or porosity of the reinforcing layer, an outer flexible, non-tacky protective membrane permanently adhered to and covering the outer side of the tacky elastomeric membrane, and a release strip temporarily adhered to and covering the inner side of the tacky membrane prior to installation of the tape. The outer non-tacky layer is provided as a separate membrane layer that is permanently adhered to the outer side of the tacky adhesive layer, either as part of the tape manufacturing process or at the job site after application of the tape to the roof. The reinforcing layer is provided in the form of an open-weave, porous, perforated, mesh, or other permeable structure strip that supports the weight of the tape when

installed across a gap between modules, and that imparts the desired structural stiffness and flexibility characteristics of the tape. The elastomeric layers can be provided as non-cross-linked, partially cross-linked, or fully cross-linked layers, and they can be uncured, partially cured, or fully cured layers.

[0022] One preferred roofing system constructed in accordance with the invention includes membrane roofing sheets installed on adjacent building modules, and an elastomeric self-bridging laminate tape pursuant hereto installed across the gap between the roofing sheets of the adjacent modules. The building modules are secured in position adjacent one another, with factory installed membrane roofing sheets covering the modules. Adjacent edge portions of the membrane sheets are cleaned and primed in preparation for installation of the tape. The self-bridging tape is then laid along the roof joint, spanning across the gap and overlapping the adjacent cleaned and primed edge portions of the roof membrane sheets. The tacky side of the tape is adhered to the roof membranes, and the non-tacky protective layer covering the outer surface of the tacky elastomer is exposed to provide an exposed weather resistant roof surface across the gap. The reinforcing laminate is provided with a width that spans across the width of the gap, and is configured to provide sufficient structural transverse stiffness to prevent the tape from sagging into the gap, while maintaining sufficient flexibility to permit expansion and contraction between the building modules, and rolling and unrolling of the tape without development of leaks along the joint.

Brief Description of the Drawings

[0023] Figure 1 is a perspective view of a building constructed from modular manufactured units that are connected together.

[0024] Figure 2 is a fragmentary cross-sectional view of a prior roof joint for mirrored building modules shown in Figure 1.

[0025] Figure 3 is a fragmentary cross-sectional view of the prior roof joint for side-by-side building modules shown in Figure 1.

[0026] Figure 4 is a view similar to Figure 2 but showing a roof system incorporating the unique aspects of the present invention, including a new and improved self-bridging roof-joint sealing tape and technique associated therewith in accordance with the invention.

[0027] Figure 5 is a view similar to Figure 3 of the roof system and tape in accordance with the invention.

[0028] Figures 6A and 6B are longitudinal fragmentary cross-sectional views of the tape.

[0029] Figures 7 and 8 are fragmentary cross-sectional views similar to Figure 6A of alternate embodiment tapes in accordance with the invention.

[0030] Figure 9 is a plan view of one suitable reinforcing scrim in a tape according to the invention.

[0031] While the invention is susceptible of various modifications and alternative constructions, certain illustrated embodiments have been shown in the drawings and will be described below in detail. It should be understood, however, that

there is no intention to limit the invention to the specific forms disclosed, but on the contrary, the intention is to cover all modifications, alternative constructions, and equivalents falling within the spirit and scope of the invention.

[0032] Reference numerals shown in the drawings correspond to the following:

10 - building

12a - building module

12b - building module

14 - membrane sheets

16 - roofing seal joint

16a - roof gap

18 - roofing seal joint

18a - roof gap

20 - bridging material

22 - adhesive/sealing tape

26 - caulk sealant

28 - bridging material

30 - self-bridging tape

32 - tacky elastomer adhesive layer

34 - reinforcing layer

36 - outer protective layer

38 - release strip

40 - completed roof system

42 - roofing seal joint

44 - roofing seal joint

50 - alternate self-bridging tape

52 - cross-linked elastomer layer

54 - tacky side of cross-linked elastomer layer

56 - non-tacky side of cross-linked elastomer layer

60 - second alternate self-bridging tape

Detailed Description of the Invention

[0033] The present invention relates to a membrane roofing system for modular buildings, such as building 10 shown in Figure 1, and to a laminate tape for sealing joints between the membrane roofing sheets of adjacent building modules such as modules 12a and 12b shown. For illustration purposes, the membrane roofing sheets 14 shown in the drawings terminate at the edges of the building modules 12a, 12b. However, the membrane roofing sheets are more typically provided folded over the edges of the modules, with a terminating strip securing the ends of the membrane to the sides of the modules.

[0034] One prior technique for establishing a roofing joint between the membrane sheets of adjacent building modules is shown in Figure 2 in connection with sealing the roof joint 16a between mirrored adjacent building modules 12a, and in Figure 3 in connection with sealing roof joint 18a between side-by-side modules 12a and 12b.

Briefly, the seal joint 16 (Figure 2) is established by securing an elongated, rigid bridging material 20 over the gap 16a between the modules, and then installing a strip of adhesive/sealing tape 22 over the bridging material 20 and overlapping a strip of the membrane roofing sheet 14 along each side of the module to seal along both sides of the length of the gap. The bridge material 20 is configured in an inverted V-shape to span across the gap at the top of the building, and is sized to overlap onto the membrane sheets 14 on each modular unit. Insulation is optionally positioned in the gap to reduce heating and cooling losses from the building prior to securing the bridge member to the roof. Conventional bridging materials include ¼ inch thick plywood, Thermal Ply, etc., with beveled edges to provide a smooth transition for the sealing tape extending therefrom to the membrane surface.

[0035] The tape 22 is adhesively secured over the bridging material 20 and to the membrane roofing sheets 14 along the length of the gap. The overlap between the tape and the membrane sheets is typically between 3 to 6 inches, with a more common overlap of approximately 4 inches. Cleaner and tape primer are used to prepare the membrane surfaces for optimum bonding with the tape. One suitable known primer includes a small percentage of butyl adhesive in a solvent base to encapsulate dust and dirt that remains after cleaning and to fill microscopic voids and cracks in the membrane substrate.

[0036] The tape 22 is provided in a roll, with release paper (e.g., Kraft paper) on the tacky underside (as installed), the release paper being removed from the tape as it is unrolled over the joint. An outer protective layer is provided over the joint

16, either as an outer layer integral with the tape, or as an additional strip that is adhered onto the outer exposed surface of the tape after the tape is secured in place over the bridging material. The tape (and outer protective layer) are then secured in position on the roof with pressure, typically by rolling a roller along the length and width thereof. The joint 16 is completed by sealing the butting, open and overlapping ends of the tape with a caulk sealant such as indicated at 26.

[0037] The roof joint 18 shown in Figure 3 is constructed in a similar manner, except that the bridging material 28 is a planar member to span across the flat junction between the modules 12a and 12b.

[0038] In accordance with one aspect of the present invention, a self-bridging laminate tape is provided to bridge a gap between adjacent building modules and sealably engage adjacent generally coextensive strips of roof membranes covering the modules at the adjacent edges of the modules, and thereby establish a sealing joint between membrane roofing sheets of adjacent building modules, and to establish a finished membrane roofing system for the modular building.

[0039] One embodiment of a self-bridging tape 30 according to the invention is shown in Figure 4 in connection with sealing the gap 16a between mirrored adjacent building modules 12a, and in Figure 5 in connection with sealing gap 18a between side-by-side modules 12a and 12b.

[0040] In carrying out this aspect of the invention, the tape 30, shown in detailed cross-section in Figures 6A and 6B, is provided with a layer 32 of tacky elastomeric adhesive, a porous reinforcing layer 34 embedded in the adhesive layer 32, an

elastic rubber or plastic protective membrane layer 36 permanently adhered to and covering the outer surface (as installed, or upper surface as shown in the drawings) of the adhesive layer 32, and a release strip 38 temporarily, releasably adhered to and covering the tacky underside (as installed, or lower surface as shown in the drawings) of the adhesive layer 32. In use, the release strip 38 is removed from the tacky lower side of the adhesive layer 32 to permit positioning of the tape lengthwise over the gap between the building modules with the tacky lower surface overlapping and sealingly adhering to the adjacent edges of the roof membranes.

[0041] The reinforcing layer 34, alternately referred to herein as scrim, is provided in the form of an open-weave strip of material comprising absorbent or loosely woven cloth, porous fiberglass fabric, wire or plastic screen-like mesh, perforated plastic or metal strip, or other porous or permeable material, e.g., generally flat material with a multiplicity of interstices, through which a non-solid may penetrate or be pressed or otherwise forced. The scrim extends the length of the tape, and is sufficiently wide to span the gap (e.g., 16a, 18a) between the modular building units. As discussed further below, the scrim is designated to produce, in combination with the tacky adhesive and protective outer layer, certain structural and flexibility characteristics in the tape. These characteristics include, but are not limited to supporting the weight of the unsupported center portion of the tape when laid over a gap between adjacent building modules.

[0042] The tacky adhesive layer 32 covers each side of the reinforcing scrim 34, and extends through the pores or perforations or openings of the scrim to establish an integral adhesive layer in which the scrim is embedded (see Figure 6). The

adhesive layer, with the reinforcing layer embedded therein, is provided with a thickness of between approximately 0.040 to 0.060 inch.

[0043] The protective outer covering 36 and tacky adhesive layer 32 are formed from elastomeric compounds, and are preferably formed from material selected from, but not limited to, one or more of the following elastomer groups: EPDM, EPR, TPO, PVC, Neoprene, Butyl, Polyisobutylene, Halogenated Butyl, Halogenated Polyisobutylene, Isobutylene, reclaimed butyl, natural rubber and Polydimethylsiloxane (PDMS). The protective outer covering 36 and tacky adhesive layer 32 are further provided in either of an uncured condition, a partially cured condition, or a fully cured condition. The protective outer covering 36 is a non-tacky, non-adhesive layer, with a thickness of between approximately 0.030 to 0.060 inch. For aesthetic and functional compatibility, the protective outer covering is typically formed from the same or a similar base compound as the roofing membrane sheets with which the tape is to be used.

[0044] The tape 30 is provided in convenient widths for the roof joints to be bridged and sealed. With a typical roof gap of 4 inches or less between installed building modules, and to establish an overlap between the tape and each of the adjacent roofing membrane sheets at the generally coextensive edges of the building modules of 3 to 6 inches for sealing engagement therebetween, the tape is provided at between 9 to 18 inches wide, with the widest tape enabling overlap onto fresh roof membrane surface for reassembling along joints that were previously disassembled. To establish seal joints in new building construction, with a 4 inch gap and a 4 inch overlap, the preferred tape is provided with a width of 12 inches. Thus, a tape that is provided to bridge a specified

maximum gap between adjacent building modules and to sealably engage adjacent generally coextensive strips of the roof membranes covering the modules will include an elastomeric adhesive layer 32 having a width substantially equal to the specified maximum gap (e.g., 4 inches in the examples discussed above) plus the aggregate widths of the coextensive edge strips of the roof membranes (e.g., 6 to 12 inches, or 8 inches in the examples discussed above), and a reinforcing layer 34 having a width of at least approximately 4 inches.

[0045] The tape 30 is characterized as being (i) sufficiently flexible longitudinally to permit its being provided in a roll for storage, shipment, handling and unrolling onto the roof, and (ii) sufficiently flexible transversely (a) to conform to uneven edges between adjacent modules, and (b) to permit relative movement between the edges of the modules, without developing leaks, yet (iii) sufficiently rigid transversely when laid across the gap between adjacent modules to establish a self-supporting, non-sagging bridge over the gap. The scrim, in cooperation with the outer protective layer and the tacky adhesive layer, are specified to meet these characteristics.

[0046] The optimum tape hereof results in the center of the applied tape being fully self-supporting, with essentially zero sagging in the center of the tape. However, those skilled in the roofing membrane arts will recognize that the benefits of the invention will be achieved provided the scrim is specified such that the center of the tape sags no more than between approximately ¼ inch and ½ inch when applied over the roof gap. In other words, a tape that exhibits a maximum of this small deformation will not detrimentally affect the performance of the roofing system established therewith.

Accordingly, a tape in accordance with the invention is sufficiently rigid transversely to form a self supporting bridge resistant to detrimental sagging (greater than approximately ½ inch) into the gap between the building modules when positioned over the gap with the tacky lower side adhered to the coextensive edge strips of the roof membranes.

[0047] In one preferred embodiment, the tape 30 is formed with a tacky adhesive layer (32) that is a blend comprising primarily butyl in an uncured condition mixed with other polymers, some of which are in a semi-cured condition, resulting in a semi-cured adhesive layer, the adhesive layer having a width of 9 to 18 inches, and a thickness of 0.040 to 0.050 inch; a reinforcing layer (34) in the form of a plastic polypropylene (or polyethylene) screen-like mesh (see Figure 9) (a) having a width of between 4 inches (for use with a 4 inch gap) to 10 inches, depending on the maximum gap width to be covered, (b) having a thickness of between approximately 0.030 inch to 0.050 inch, with a nominal thickness of 0.040 inch, and (c) with openings sized at approximately 1/16th to 1/8th inch across corners; a outer protective layer (36) of fully cured EPDM rubber (for use with EPDM roofing membranes), or other non-tacky protective rubber or plastic layer, permanently adhered to and covering the outer surface of the butyl adhesive layer, the cured non-tacky elastomer having a width of approximately 12 inches and a thickness of 0.030 to 0.060 inch; and a paper release strip releasably adhered to and covering the tacky underside of the adhesive butyl layer, the release paper having a width extending slightly beyond the width of the adhesive layer.

[0048] These designations result in a self-supporting tape that exhibits the previously identified characteristics, and that is capable of reliably bridging and sealing

gaps between adjacent modules. Alternate preferred designations of the tape constituents will meet the performance characteristics of the above-designated tape construction. However, it will be understood that the stiffness and flexibility characteristics of the scrim material will be the primary factors in obtaining characteristics comparable with the above-designated embodiment.

[0049] A preferred method of forming the above-designated self-bridging tape 30 is a continuous conveyor-type process that includes the following:

(A) providing the release paper on a linearly moving conveyor,

(B) extruding the butyl adhesive blend (from processing mixers) onto the moving release paper,

(C) introducing the scrim onto the exposed face of the adhesive mixture and the elastomeric protective layer onto the scrim layer,

(D) passing the stacked release paper, adhesive layer, scrim and elastomeric protective layer continuously through one or more sets of opposing rollers to embed the scrim into the adhesive layer and to establish an initial adhesion between the adhesive layer and the elastomeric protective layer, and

(E) rolling the tape into tight rolls of predetermined lengths for stocking and delivery purposes.

[0050] Alternate methods of forming a self-bridging tape in accordance herewith will be readily devised by those skilled in the adhesive manufacturing arts. By way of example, and without limiting effect, the finished layer of reinforced tacky elastomer may be provided by extruding a first adhesive layer onto the release paper,

laying the scrim strip onto the first adhesive layer, and then extruding a second adhesive layer onto the scrim such that the two adhesive layers will merge into a cohesive reinforced layer upon passing through the pressure rollers.

[0051] In carrying another aspect of the invention, the seal joints 42 and 44 of the finished roof system 40 of the building 10 are established by

(A) preparing strips along the edges of adjacent membrane roofing liners 14 with a cleaner and tape primer,

(B) optionally installing insulation in the gap 16a, 18a to reduce heating and cooling losses from the building ,

(C) unrolling the self-bridging tape 30 along the length of the gap between the adjacent modules, positioning the tape to overlap the cleaned and primed membrane surfaces, for an overlap of approximately 4 inches, and removing the release paper 38 from the underside of the tape as it is unrolled into position over the gap,

(D) securing the tape to the membrane sheets, in position over the gap, with pressure applied to the outer protective cover such as with a roller along the length and width thereof, and

(E) sealing the butting, open and overlapping ends of the tape with a caulk sealant 26.

[0052] In an alternate embodiment, the self-bridging tape 50, shown in detailed cross-section in Figure 7, includes a layer 52 of cross-linked elastomeric compound provided with an adhesive tacky side underside 54 and a non-tacky outer side 56; a porous reinforcing layer 34 embedded in the tacky portion 54 of the cross-linked

elastomer layer; and a release strip 38 releasably adhered to and covering the tacky underside 54 of the cross-linked elastomer layer. The reinforcing layer 34 is integrally embedded in the cross-linked elastomer 52 during fabrication of the tape, with elastomer cross-links extending through the reinforcing layer to assist in bonding the reinforcing layer therein. The cross-linked elastomer layer is preferably formed from a compound including, but not limited to, of one or more materials selected from the group consisting of the following elastomers: EPDM, EPR, TPO, PVC, Neoprene, Butyl, Polyisobutylene, Halogenated Butyl, Halogenated Polyisobutylene, Isobutylene, reclaimed butyl, natural rubber and Polydimethylsiloxane (PDMS). The non-tacky side 56 of the elastomer is provided for during production of the tape as an elastic rubber or plastic protective layer integrally covering the tacky elastomer, commonly of the same or a similar material as the membrane roofing sheets with which the tape is to be used. As with tape 30, the tape 50 is characterized as being (i) sufficiently flexible longitudinally to permit its being provided in a roll for storage, shipment, handling and unrolling onto the roof, and (ii) sufficiently flexible transversely to permit relative movement between the edges of the building modules without developing leaks, yet (iii) sufficiently rigid transversely when applied to the roof gap between adjacent modules to form a self-supporting, non-sagging bridge over the gap. In one preferred embodiment, the tacky adhesive layer of tape 50 is formed from a compound of a pre-cross-linked butyl blend that cross-links further in-place over time, resulting in enhanced strength as time passes. Alternately, a fully cross-linked adhesive layer may be provided during fabrication of the tape. A finished roofing

system is established for a modular building with tape 50 as described above in connection with tape 30.

[0053] In a second alternate embodiment, the self-bridging tape 60, shown in detailed cross-section in Figure 8, includes a layer 32 of tacky elastomeric adhesive; a porous reinforcing layer 34 embedded in the adhesive layer; and at least one release strip 38 releasably adhered to and covering one side of the adhesive layer. The tape 60 is similarly characterized as being (i) sufficiently flexible longitudinally to permit its being provided in a roll for storage, shipment, handling and unrolling onto the roof, and (ii) sufficiently flexible transversely to permit relative movement between the edges of the building modules without developing leaks, yet (iii) sufficiently rigid transversely when applied to the roof gap between adjacent modules to form a self-supporting, non-sagging bridge over the gap. The finished roofing system is established with this tape 60 as generally discussed above, except that a non-tacky outer protective layer is applied to the exposed tacky side of the tape after the tape is applied on the job to the adjacent roofing membranes 14 and over the gap between the adjacent modules. When provided after application of the tape over the gap, the non-tacky layer is fabricated from, but not limited to, one or more of the following elastomers: EPDM, EPR, TPO, PVC, Neoprene, Butyl, Polyisobutylene, Halogenated Butyl, Halogenated Polyisobutylene, Isobutylene, reclaimed butyl, natural rubber and Polydimethylsiloxane (PDMS). The non-tacky layer is typically provided from the same elastomer family as the roofing membrane sheet with which the tape is to be used, and may be provided by the installer, either as a separate

strip or by stripping in the membrane that is normally supplied draping over the edge of the building module.

[0054] In accordance with yet another aspect of the invention, the self-bridging tape disclosed herein may also be used to bridge and seal gaps between other structural construction members. For example, the tape may be used to seal gaps between walls, floors, concrete and other joints encountered in construction of buildings and other similar structures. The tape 60 without the protective cured layer may be used, for example, to bond a metal cap in position on the roof of a building, and may be used in combination with a tape 30, 40 having the cured layer for such purposes. The tape may also be used to seal joints such as in concrete sewer pipes, concrete culverts, concrete vaults. And the tape may be used to seal construction joints between the same as well as different substrates, including metal-to-metal, wood-to-wood, metal-to-wood, wood-to-concrete, metal-to-concrete, and rubber or plastic to itself or to any of the above-mentioned substrate materials. In particular, it has been learned that the reinforced tape hereof, made with adhesive butyl blends, is suitable to bond to each of these, properly cleaned, and primed as required, substrates. Alternately, as will be recognized by those skilled in the adhesive arts, a tacky adhesive layer of an alternate composition may be preferred for certain ones of these substrates. In such instances, the adhesive butyl will be replaced by a tacky adhesive composition identified above to provide better adhesion with such substrates.

[0055] From the foregoing, it will be apparent that the present invention brings to the art a new and improved roofing system for modular building construction,

and a unique tape which, by virtue of its self-bridging self-supporting, yet flexible characteristics, bridges and seals the joints between the membrane sheets of adjacent construction modules, and establishes a finished membrane roofing system therefor, without the need for a separate bridge material or a stiff reinforced outer protective layer of prior roof-joint bridging systems. Accordingly, the invention eliminates the material and labor costs associated with cutting and installing separate bridging material of prior joint sealing arrangements, provides a seal with increased flexibility to reduce leakage associated with prior arrangements, and promotes ease of removal for disassembly, inspection and repair.